

CLAIMS

What is claimed is:

1. A method for determining a direction of arrival (DOA) of a Radio Frequency
5 (RF) signal transmitted by a remote unit in a wireless communication system, comprising:
receiving said RF signal with a plurality of antennas of an antenna array;
determining a preliminary DOA for said RF signal received with said plurality of
antennas of said antenna array;
selecting a coefficient for said plurality of antennas of said antenna array based at
10 least in part upon said preliminary DOA;
modifying said RF signal with said coefficient for said plurality of antennas of said
antenna array to generate a modified RF signal; and
determining said DOA of said RF signal transmitted by said remote unit in said
wireless communication system with said modified RF signal.

2. The method of Claim 1, wherein said coefficient is an array distortion
coefficient.

3. The method of Claim 1, wherein determining said DOA of said RF signal
20 transmitted by said remote unit in said wireless communication system with said modified
RF signal incorporates corrections for mutual coupling distortion of said plurality of
antennas of said antenna array.

4. The method of Claim 2, wherein selecting said array distortion coefficient for
25 said plurality of antennas of said antenna array based at least in part upon said preliminary

DOA utilizes a relationship between a composite array manifold, an ideal array manifold and a pre-multiplying linear distortion term.

5. The method of Claim 4, wherein said pre-multiplying linear distortion term
5 incorporates a collective effect of array distortion for said plurality of antennas of said antenna array.

6. The method of Claim 1, wherein selecting a coefficient for said plurality of
antennas of said antenna array based at least in part upon said preliminary DOA further
comprises generating a coefficient database.

7. The method of Claim 6, wherein selecting a coefficient for said plurality of
antennas of said antenna array based at least in part upon said preliminary DOA comprises:
identifying a target DOA for said preliminary DOA; and
15 selecting said coefficient from said coefficient database that corresponds to said target DOA.

8. The method of Claim 6, wherein generating said coefficient database
comprises:

selecting a first DOA range;
20 identifying a plurality of calibration measurements within said first DOA range;
conducting a linear averaging operation of said plurality of calibration measurements
to yield said coefficient;
associating a target DOA with said coefficient; and
storing said target DOA associated with said coefficient in said coefficient database.

9. The method of Claim 1, wherein modifying said RF signal with said coefficient for said plurality of antennas of said antenna array to generate said modified RF signal employs a direct matrix inversion.

5 10. The method of Claim 1, wherein modifying said RF signal with said coefficient for said plurality of antennas of said antenna array to generate said modified RF signal employs a least squares operation.

10 11. The method of Claim 1, wherein modifying said RF signal with said coefficient for said plurality of antennas of said antenna array to generate said modified RF signal employs a maximum likelihood operation.

15 12. The method of Claim 1, wherein determining said DOA of said RF signal transmitted by said remote unit in said wireless communication system with said modified RF signal comprises performing an additional DOA operation that utilize said coefficient in determining said DOA of said RF signal transmitted by said remote unit in said wireless communication system with said modified RF signal.

20 13. The method of Claim 12, wherein said additional DOA operation comprises a modified Iterative Quadratic Maximum Likelihood (IQML) method.

14. An apparatus for determining a direction of arrival (DOA) of a Radio Frequency (RF) signal transmitted by a remote unit in a wireless communication system, comprising:

a plurality of antennas of an antenna array configured to receive said RF signal;

5 a first DOA determinator configured to determine a preliminary DOA for said RF signal received with said plurality of antennas of said antenna array;

a coefficient selector configured to select a coefficient for said plurality of antennas of said antenna array based at least in part upon said preliminary DOA;

10 a signal modifier configured to modify said RF signal with said coefficient for said plurality of antennas of said antenna array to generate a modified RF signal; and

a second DOA determinator configured to determine said DOA of said RF signal transmitted by said remote unit in said wireless communication system with said modified RF signal.

15 15. The apparatus of Claim 14, wherein said coefficient is an array distortion coefficient.

20 16. The apparatus of Claim 14, wherein said second DOA determinator is configured to incorporate a correction for mutual coupling distortion of said plurality of antennas of said antenna array.

17. The apparatus of Claim 15, wherein said coefficient selector is configured to utilize a relationship between a composite array manifold, an ideal array manifold and a pre-multiplying linear distortion term.

18. The apparatus of Claim 17, wherein said pre-multiplying linear distortion term incorporates a collective effect of array distortion for said plurality of antennas of said antenna array.

5 19. The apparatus of Claim 14, wherein said coefficient selector comprises a coefficient processor configured to identify a target DOA for said preliminary DOA and select said coefficient from a coefficient database that corresponds to said target DOA.

10 20. The apparatus of Claim 19, further comprising a database generator configured to generate said coefficient database.

20 21. The apparatus of Claim 20, wherein said database generator comprises:
a calibration measurement database having a plurality of calibration measurements;
and

15 a database processor configured to select a first DOA range and a group of said plurality of calibration measurements within said first DOA range, said database processor further configured to conduct a linear averaging operation of said group of said plurality of calibration measurements to yield said coefficient and associate a target DOA with said coefficient.

20 22. The apparatus of Claim 14, wherein said signal modifier employs a direct matrix inversion.

25 23. The apparatus of Claim 14, wherein said signal modifier employs a least squares operation.

24. The apparatus of Claim 14, wherein said signal modifier employs a maximum likelihood operation.

5 25. The apparatus of Claim 14, wherein said second DOA determinator is configured to perform an additional DOA operation utilizing said coefficient in determining said DOA of said RF signal transmitted by said remote unit in said wireless communication system with said modified RF signal.

10 26. The apparatus of Claim 25, wherein said additional DOA operation is a modified Iterative Quadratic Maximum Likelihood (IQML) method.